



Illinois Department of Transportation

To: John Fortman Attn: District One
From: John D. Baranzelli
Subject: Pavement Design
Date: October 19, 2012

A handwritten signature, likely of John D. Baranzelli, written in black ink.

FAP Route 305 (Willow Road)
Cook County
From Des Plaines River to Culligan Parkway

We have reviewed the revised pavement selection for the project, which was submitted to BDE by email dated October 5, 2012. The life cycle cost analysis favors the rigid pavement design by more than 10% for both Willow Road and Sanders Road. The approved pavement design for this project is as follows:

Willow Road (Pavement Reconstruction)

10.25 inches of PCC Pavement with Tied PCC Curb & Gutter/Shoulder
4.5 inches of Stabilized Subbase
12 inches of Aggregate Subgrade

Sanders Road (Pavement Reconstruction)

9 inches of PCC Pavement with Tied PCC Curb & Gutter
12 inches of Aggregate Subgrade

If you have any questions, please contact Paul Niedernhofer at (217) 524-1651.



Illinois Department of Transportation

Memorandum

To: John D. Baranzelli, PE Attn: Paul R. Niedernhofer
From: John Fortmann By: Jose A. Dominguez
Subject: Pavement Analysis*
Date: October 5, 2012

*Route: Willow Road Section: 1616-R
Limits: Des Plaines River to Culligan Pkwy County: Cook
Contract No.: 60L75 Job No.: D-91-298-99
Letting: 06CY15

We have completed the pavement analysis for the above captioned location. Review by the Central Office is required since the total pavement area for reconstruction exceeds 4,750 square yards. The following is the scope of the project:

a.) Pavement reconstruction of Willow Road for a total length of approximately 3,625 feet to accommodate up to three 12 foot through lanes and two left turn lanes in either direction.

b.) Pavement reconstruction of Sanders Road for a total length of 2,240 feet to accommodate two 12 foot through lanes, a right turn lane, and two left turn lanes in the northbound direction and two 12 foot through lanes, two right turn lanes, and two left turn lanes in the southbound direction.

District 1 performed a mechanistic pavement analysis on the segment of Willow Road using a 20 year design period. We recommend a mechanistic-rigid pavement design based on the life cycle cost analysis which favors PCC pavement by 12.3%

a.) Willow Road

Tied PCC Curb and Gutter / Tied PCC Shoulder
Pavement Reconstruction

- 10 ¼" PCC Pavement (Jointed) ¹
- 4 ½" Stabilized Subbase ²
- 12" Aggregate Subgrade Improvement ³

A 20 year pavement analysis was performed on the Sanders Rd segment. We recommend a mechanistic-rigid pavement design based on the life cycle cost analysis which favors PCC pavement by 13.5%.

b.) Sanders Road ⁴

Tied PCC Curb and Gutter
Pavement Reconstruction

- 9" PCC Pavement (Jointed) ⁵
- 12" Aggregate Subgrade Improvement ³

John D. Baranzelli
October 5, 2012
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¹ Designer Note 1: Use pay item **42000506, "PORTLAND CEMENT CONCRETE PAVEMENT 10 1/4" (JOINTED)"** paid in square yards.

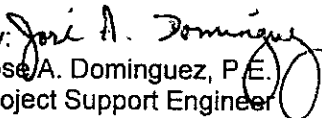
² Designer Note 2: Use pay item **31200502, STABILIZED SUBBASE - HOT-MIX ASPHALT, 4 1/2"**, paid in square yards. To be used only for pavement that does not have enclosed drainage (STA 412+35 to 426+74.56).

³ Designer Note 3: Use pay item **30300112, "AGGREGATE SUBGRADE IMPROVEMENT 12" "** paid in square yards.

⁴ Designer Note 4: Sanders Road is subject to local jurisdictional approval and concurrence. A Stabilized Subbase is optional for the PCC pavement recommended.

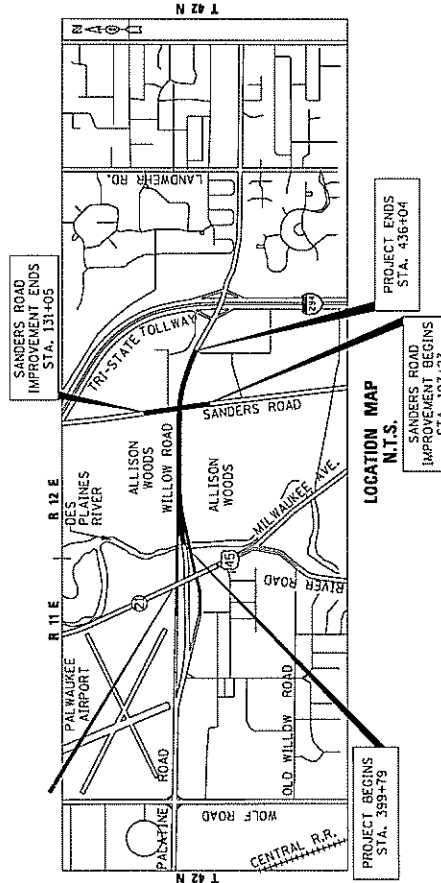
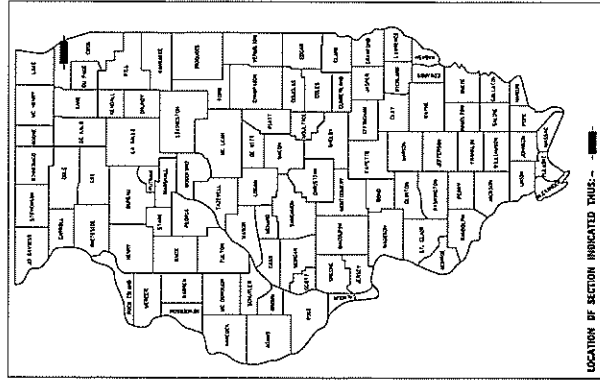
⁵ Designer Note 5: Use pay item **42000401, "PORTLAND CEMENT CONCRETE PAVEMENT 9" (JOINTED)"** paid in square yards.

If you have any questions or need additional information, please contact Jenpai Chang, Acting Pavement Design Engineer, at (847)705-4432.

By: 
Jose A. Dominguez, P.E.
Project Support Engineer

STATE	SECTION	COUNTY	SHEET
ILL.	201	K-R-1	100
			101

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROPOSED
HIGHWAY PLANS
F.A.P. ROUTE 305 (WILLOW ROAD)



FULL SIZE PLANS HAVE BEEN PREPARED USING STANDARD
 ENGINEERING SCALES. REDUCED SIZED PLANS WILL NOT
 CONFORM TO STANDARD SCALES. IN MAKING MEASUREMENTS
 ON REDUCED PLANS, THE ABOVE SCALES MAY BE USED.

JULIE
 JOINT UTILITY LOCATION INFORMATION FOR EXCAVATION
 1-800-892-8123

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: Willow Road	Comments: per conversation with Mel Mangoba, analyze as 6 lanes		
Section: 1616-R	Design Date: 09/25/2012	JK	<-- BY
County: Cook	Modify Date: 10/01/2012	SJP	<-- BY
Location: E. of Des Plaines River Rd to Culligan Pk			
Facility Type: Other Marked State Route			
# of Lanes = 6 or more			
Road Class: I			
Rural or Urban ? Urban			
Subgrade Support Rating (SSR): Poor			
Construction Year: 2015			
Design Period (DP) = 20 years			

Structural Design Traffic			
Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane
PV = 0	63,876	92.1%	P = 8%
SU = 250	2,621	3.8%	S = 37%
MU = 750	2,843	4.1%	M = 37%
Struct. Design ADT = 69,340		(2025)	

FLEXIBLE PAVEMENT		RIGID PAVEMENT	
Cpv = 0.15		Cpv = 0.15	
Csu = 132.5		Csu = 143.81	
Cmu = 482.53		Cmu = 696.42	
TF flexible (Actual) = 12.74	(Actual ADT)	TF rigid (Actual) = 17.46	(Actual ADT)
TF flexible (Min) = 2.92	(Min ADT Fig. 54-2.C)	TF rigid (Min) = 4.13	(Min ADT Fig. 54-2.C)

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv = 0.15
 Csu = 132.5
 Cmu = 482.53
 TF flexible (Actual) = 12.74 (Actual ADT)
 TF flexible (Min) = 2.92 (Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv = 0.15
 Csu = 143.81
 Cmu = 696.42
 TF rigid (Actual) = 17.46 (Actual ADT)
 TF rigid (Min) = 4.13 (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement		JPC Pavement	
Use TF flexible = 12.74		Use TF rigid = 17.46	
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)		Edge Support = Tied Shoulder or C.&G.	
HMA Mixture Temp. = 73.7 deg. F (Fig. 54-5.C)		Rigid Pavt Thick. = 10.25 in. (Fig. 54-4.E)	
Design HMA Mixture Modulus (E _{HMA}) = 730 ksi (Fig. 54-5.D)			
Design HMA Strain (ε _{HMA}) = 58 (Fig. 54-5.E)			
Full Depth HMA Design Thickness = 12.50 in. (Fig. 54-5.F)			
Limiting Strain Criterion Thickness = 14.40 in. (Fig. 54-5.I)			
Use Full-Depth HMA Thickness = 12.50 inches		CRCP Thickness = 9.75 in. (Fig. 54-4.M)	

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC		Unbonded Concrete Overlay	
Use TF flexible = 12.74		Review 54-4.03 for limitations and special considerations.	
District = 3,4,5,6		JPCP Thickness = NA inches	
HMA Overlay Design Thickness = 11.00 in. (Fig. 54-5.U)			

CONTACT BMPP FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

Class I Roads 4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	Class II Roads 2 lanes with ADT > 2000 One way Street with ADT <= 3500	Class III Roads 2 Lanes (ADT 750 -2000)	Class IV Roads 2 Lanes (ADT < 750)
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Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	PV	SU	MU
	0	500	1500
	0	250	750
	No Min	No Min	No Min

Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

Class	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
	Csu	Cmu	Csu	Cmu
	143.81	696.42	132.50	482.53
	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

Number of Lanes	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
	P	S	M	P	S	M
	100%	100%	100%	100%	100%	100%
	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

Standard Design

FULL-DEPTH HMA PAVEMENT

ROUTE: Willow Road
SECTION: 1616-R
COUNTY: Cook
LOCATION: E. of Des Plaines River Rd to Culligan Pkwy

MAINTENANCE

FACILITY TYPE: NON-INTERSTATE

PROJECT LENGTH: 3625 FT ==> 0.69 Miles
OF CENTERLINES: 4 CL
OF LANES: 6 LANES
OF EDGES: 4 EP
LANE WIDTH - AVERAGE: 12 FT
SHOULDER WIDTH: 4 FT
HMA Inside
HMA Outside

PAVEMENT THICKNESS (FLEXIBLE): 12.50 IN
SHOULDER THICKNESS: 12.50 IN
POLY OVERLAY THICKNESS: 2.25 IN

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		5.85	12.74	12.74

HMA COST PER TON	UNIT PRICE
HMA SURFACE	\$95.00 /TON
HMA TOP BINDER	\$95.00 /TON
HMA LOWER BINDER	\$80.00 /TON
HMA BINDER (LEVELING)	\$80.00 /TON
HMA SHOULDER	\$80.00 /TON

INITIAL COSTS	THICKNESS	100% QUANTITY UNIT	UNIT PRICE	COST
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HMA PAVEMENT (FULL-DEPTH)	(12.50")	29,000 SQ YD	\$51.23 /SQ YD	\$0
HMA SURFACE COURSE	(2.00")	29,000 SQ YD	\$9.15 /SQ YD	\$265,350
HMA TOP BINDER COURSE	(1.50")	29,000 SQ YD	\$8.96 /SQ YD	\$259,840
HMA LOWER BINDER COURSE	(0.75")	29,000 SQ YD	\$29.78 /SQ YD	\$863,620

HMA SHOULDER	(12.50")	7,894 TONS	\$60.00 /TON	\$473,556
CURB & GUTTER	0 LIN FT		\$30.00 /LIN FT	\$0
SUBBASE GRAN MATL T/C (TONS)	0 TONS		\$25.00 /TON	\$0
IMPROVED SUBGRADE	41,083 SQ YD		\$10.00 /SQ YD	\$410,830

Reserved For User Supplied Item	0 SQ YD		\$0.00 /SQ YD	\$0
Reserved For User Supplied Item	0 SQ YD		\$0.00 /SQ YD	\$0
PAVEMENT REMOVAL	29,000 SQ YD		\$0.00 /SQ YD	\$0
SHOULDER REMOVAL	11,278 SQ YD		\$0.00 /SQ YD	\$0

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUCTION INITIAL COST: \$2,439,896

FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE: \$144,944

MAINTENANCE COSTS:	THICKNESS	MATERIAL	UNIT COST
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ROUTINE MAINTENANCE ACTIVITY

HMA OVERLAY P/MT SURF	(2.00")	(HMA SURFACE MIX)	\$9.15 /SQ YD
HMA OVERLAY P/MT	(2.25")	(HMA SURFACE MIX)	\$10.29 /SQ YD
HMA SURFACE MIX	(1.50")	(HMA SURFACE MIX)	\$8.96 /SQ YD
HMA BINDER MIX	(0.75")	(Levelling Binder Mix)	\$3.43 /SQ YD
HMA OVERLAY SHLD	(Year 30)	(HMA SHLD MIX)	\$10.29 /SQ YD
HMA OVERLAY SHLD	(2.00")	(HMA SHLD MIX)	\$9.15 /SQ YD

MILLING (2.00 IN)

PARTIAL DEPTH P/MT PATCH	(Mill & Fill Surf)	(HMA SURFACE MIX)	\$90.83 /SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)	(HMA SHLD MIX)	\$99.15 /SQ YD

PARTIAL DEPTH P/MT PATCH	(Mill & Fill +2.00")	(HMA L BINDER)	\$89.71 /SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00")	(HMA SHLD MIX)	\$89.15 /SQ YD

LONGITUDINAL SHOULDER JOINT ROUT & SEAL			\$2.00 /LIN FT
CENTERLINE JOINT ROUT & SEAL			\$2.00 /LIN FT
RANDOM THERMAL CRACK ROUT & SEAL			\$2.00 /LIN FT

FLEXIBLE TOTAL LIFE-CYCLE COST	\$3,290,810
FLEXIBLE TOTAL ANNUAL COST PER MILE	\$195,493

PCC PAVEMENT

JPCP

ROUTE Willow Road
SECTION 1616-R
COUNTY Cook
LOCATION E. of Des Plaines River Rd to Culligan Pkwy

FACILITY TYPE NON-INTERSTATE

PROJECT LENGTH 3625 FT ==> 0.69 Miles
OF CENTERLINES 4 CL
OF LANES 6 LANES
OF EDGES 4 EP
LANE WIDTH - AVERAGE 12 FT
SHOULDER WIDTH 4 FT
PCC Inside
PCC Outside

MAINTENANCE

PAVEMENT THICKNESS (RIGID) JPCP 10.25 IN TIED SHLD
SHOULDER THICKNESS 10.00 IN

POLY OVERLAY THICKNESS 2.50 IN

RIGID PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
Worksheet Construction Type is Reconstruction		8.26	17.46	17.46 JPCP
The Pavement Type is				

INITIAL COSTS	ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
JPC PAVEMENT		(10.25')	29,000	SQ YD	\$45.99 /SQ YD	\$1,333,710
PAVEMENT REINFORCEMENT			0	SQ YD	\$0.00 /SQ YD	\$0
STABILIZED SUBBASE		(4.00')	15,195	SQ YD	\$16.00 /SQ YD	\$243,126
PCC SHOULDERS		(10.00" to 10.00')	11,278	SQ YD	\$40.99 /SQ YD	\$462,285
CURB & GUTTER			0	LIN FT	\$30.00 /LIN FT	\$0
SUBBASE GRAN MATL TY C		(~3.82')	0	TONS	\$25.00 /TON	\$0
IMPROVED SUBGRADE		Modified Soil	41,083	SQ YD	\$10.00 /SQ YD	\$410,830
Reserved For User Supplied Item			0		\$0.00	\$0
Reserved For User Supplied Item			0		\$0.00	\$0
PAVEMENT REMOVAL			29,000	SQ YD	\$0.00 /SQ YD	\$0
SHOULDER REMOVAL			11,278	SQ YD	\$0.00 /SQ YD	\$0
Note: * Denotes User Supplied Quantity						
RIGID CONSTRUCTION INITIAL COST						\$2,449,951
RIGID CONSTRUCTION ANNUAL COST PER MILE						\$145,541

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	DEPTH	UNIT COST
ROUTINE MAINTENANCE ACTIVITY				
HMA POLICY OVERLAY	(2.50')		2.00'	\$0.00 /LANE-MILE / YEAR
HMA POLICY OVERLAY PMVT	(2.50')		2.00'	
HMA SURFACE MIX	(1.50')	HMA Surface Mix	1.00'	\$11.44 /SQ YD
HMA BINDER MIX	(1.00')	Leveling Binder Mix	1.00'	\$6.86 /SQ YD
HMA POLICY OVERLAY SHLD	(2.50')		2.00'	\$4.58 /SQ YD
				\$11.44 /SQ YD
CLASS A PAVEMENT PATCHING				
CLASS B PAVEMENT PATCHING				\$170.00 /SQ YD
CLASS C SHOULDER PATCHING				\$130.00 /SQ YD
				\$110.00 /SQ YD
PARTIAL DEPTH PMVT PATCH (Mill & Fill HMA Surf)		(HMA SURFACE MIX)	1.00'	\$88.17 /SQ YD
PARTIAL DEPTH PMVT PATCH (Mill & Fill HMA 2.50')		(HMA SURFACE MIX)	2.00'	\$93.49 /SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL				
CENTERLINE JOINT ROUT & SEAL				\$2.00 /LIN FT
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL				\$2.00 /LIN FT
RANDOM CRACK ROUT & SEAL				\$2.00 /LIN FT
(100% Rehab = 100.00' / Station / Lane)				
RIGID TOTAL LIFE-CYCLE COST				\$2,929,452
RIGID TOTAL ANNUAL COST PER MILE				\$174,026

FULL-DEPTH HMA PAVEMENT
HMA OVERLAY OF RUBBLIZED PCC PAVEMENT
Figure 54-7.C
STANDARD DESIGN

MAINTENANCE COSTS:	ITEM		%	QUANTITY	UNIT COST	COST	PRESENT WORTH
YEAR 5	LONG SHLD JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	CNTR LINE JOINT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	11,963	\$2.00	\$23,926	
	PD PVMT PATCH M&F SURF	SQ YD	0.10%	29	\$90.83	\$2,634	
	PWFn =	0.8626	PW =	0.8626	X	\$84,560	\$72,942
YEAR 10	LONG SHLD JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	CNTR LINE JOINT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	11,963	\$2.00	\$23,926	
	PD PVMT PATCH M&F SURF	SQ YD	0.50%	145	\$90.83	\$13,170	
	PWFn =	0.7441	PW =	0.7441	X	\$95,096	\$70,760
YEAR 15	MILL PVMT & SHLD 2.00"	SQ YD	100.00%	40,278	\$2.50	\$100,695	
	PD PVMT PATCH M&F ADD'L 2.00"	SQ YD	1.00%	290	\$89.71	\$26,016	
	HMA OVERLAY PVMT 2.00"	SQ YD	100.00%	29,000	\$9.15	\$265,350	
	HMA OVERLAY SHLD 2.00 "	SQ YD	100.00%	11,278	\$9.15	\$103,194	
	PWFn =	0.6419	PW =	0.6419	X	\$495,255	\$317,885
YEAR 20	LONG SHLD JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	CNTR LINE JOINT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	11,963	\$2.00	\$23,926	
	PD PVMT PATCH M&F SURF	SQ YD	0.10%	29	\$90.83	\$2,634	
	PWFn =	0.5537	PW =	0.5537	X	\$84,560	\$46,819
YEAR 25	LONG SHLD JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	CNTR LINE JOINT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	11,963	\$2.00	\$23,926	
	PD PVMT PATCH M&F SURF	SQ YD	0.50%	145	\$90.83	\$13,170	
	PWFn =	0.4776	PW =	0.4776	X	\$95,096	\$45,418
	HMA SD						
YEAR 30	NON-INTERSTATE						
	MILL PVMT & SHLD 2.00"	SQ YD	100.00%	40,278	\$2.50	\$100,695	
	PD PVMT PATCH M&F ADD'L 2.00"	SQ YD	2.00%	580	\$89.71	\$52,032	
	PD SHLD PATCH M&F ADD'L 2.00"	SQ YD	1.00%	113	\$89.15	\$10,074	
	HMA OVERLAY PVMT 2.25"	SQ YD	100.00%	29,000	\$10.29	\$298,519	
	HMA OVERLAY SHLD 2.25 "	SQ YD	100.00%	11,278	\$10.29	\$116,093	
	PWFn =	0.4120	PW =	0.4120	X	\$577,413	\$237,887
YEAR 35	LONG SHLD JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	CNTR LINE JOINT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	11,963	\$2.00	\$23,926	
	PD PVMT PATCH M&F SURF	SQ YD	0.10%	29	\$90.83	\$2,634	
	PWFn =	0.3554	PW =	0.3554	X	\$84,560	\$30,051
YEAR 40	LONG SHLD JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	CNTR LINE JOINT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	11,963	\$2.00	\$23,926	
	PD PVMT PATCH M&F SURF	SQ YD	0.50%	145	\$90.83	\$13,170	
	PWFn =	0.3066	PW =	0.3066	X	\$95,096	\$29,152
							\$850,914
	ROUTINE MAINTENANCE ACTIVITY			4.12	0.00	\$0	\$0
							MAINTENANCE LIFE-CYCLE COST \$850,914
45 YEARS	CRFn =	0.040785					MAINTENANCE ANNUAL COST PER MILE \$50,549

JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT COST	COST	PRESENT WORTH
YEAR 10						
	PAVEMENT PATCH CLASS B	SQ YD	0.10%	29	\$130.00	\$3,770
		PWFn =	0.7441	PW =	0.7441 X	\$3,770
YEAR 15						
	PAVEMENT PATCH CLASS B	SQ YD	0.20%	58	\$130.00	\$7,540
		PWFn =	0.6419	PW =	0.6419 X	\$7,540
YEAR 20						
	PAVEMENT PATCH CLASS B	SQ YD	2.00%	580	\$130.00	\$75,400
	SHOULDER PATCH CLASS C	SQ YD	0.50%	56	\$110.00	\$6,160
	LONGITUDINAL SHLD JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000
	CENTERLINE JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000
		PWFn =	0.5537	PW =	0.5537 X	\$139,560
YEAR 25						
	PAVEMENT PATCH CLASS B	SQ YD	3.00%	870	\$130.00	\$113,100
	SHOULDER PATCH CLASS C	SQ YD	1.00%	113	\$110.00	\$12,430
		PWFn =	0.4776	PW =	0.4776 X	\$125,530
YEAR 30	NON-INTERSTATE					
	PAVEMENT PATCH CLASS B	SQ YD	4.00%	1,160	\$130.00	\$150,800
	SHOULDER PATCH CLASS C	SQ YD	1.50%	169	\$110.00	\$18,590
	HMA POLICY OVERLAY 2.5" (PVM	SQ YD	100.00%	29,000	\$11.44	\$331,688
	HMA POLICY OVERLAY 2.5" (SHLI	SQ YD	100.00%	11,278	\$11.44	\$128,992
		PWFn =	0.4120	PW =	0.4120 X	\$630,070
YEAR 35	NON-INTERSTATE					
	LONGITUDINAL SHLD JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000
	CENTERLINE JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000
	RANDOM CRACK R&S	LIN FT	50.00%	10,875	\$2.00	\$21,750
	REFLECTIVE TRANSVERSE CRACK	LIN FT	40.00%	6,970	\$2.00	\$13,940
	PD PVMT PATCH M&F HMA 2.50"	SQ YD	0.10%	29	\$93.49	\$2,711
		PWFn =	0.3554	PW =	0.3554 X	\$96,401
YEAR 40	NON-INTERSTATE					
	PAVEMENT PATCH CLASS B	SQ YD	0.50%	145	\$130.00	\$18,850
	LONGITUDINAL SHLD JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000
	CENTERLINE JT R&S	LIN FT	100.00%	14,500	\$2.00	\$29,000
	REFLECTIVE TRANSVERSE CRACK	LIN FT	60.00%	10,454	\$2.00	\$20,908
	RANDOM CRACK R&S	LIN FT	50.00%	10,875	\$2.00	\$21,750
	PD PVMT PATCH M&F HMA 2.50"	SQ YD	0.50%	145	\$93.49	\$13,556
		PWFn =	0.3066	PW =	0.3066 X	\$133,064
	ROUTINE MAINTENANCE ACTIVITY					\$0
						\$0
	MAINTENANCE LIFE-CYCLE COST					\$479,501
45 YEARS	CRFn =	0.040785	MAINTENANCE ANNUAL COST PER MILE			\$28,485

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised :

4:02 PM 09/20/2012

CONSTRUCTION	INITIAL COST	PRESENT WORTH		HMA
		ANNUAL COST PER MILE		
		JPCP		
		\$2,449,951		\$2,439,896
		\$145,541		\$144,944
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH		\$850,914
		ANNUAL COST PER MILE		
		\$479,501		\$50,549
		\$28,485		
TOTAL	LIFE-CYCLE COST	PRESENT WORTH		\$3,290,810
		ANNUAL COST PER MILE		
		\$2,929,452		\$195,493
		\$174,026		

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>	JPCP	\$174,026
OTHER OPTIONS (LOWEST TO HIGHEST):		HMA	\$195,493
			12.3%

(Enter Data in Gray Shaded Cells)

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

Class I Roads	Class II Roads	Class III Roads	Class IV Roads
4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	2 lanes with ADT > 2000 One way Street with ADT <= 3500	2 Lanes (ADT 750 -2000)	2 Lanes (ADT < 750)

Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	PV	SU	MU
Interstate or Supplemental Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

Class	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

Number of Lanes	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
	P	S	M	P	S	M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE	Sanders Road
SECTION	1616 R
COUNTY	Cook
LOCATION	at Willow Road

MAINTENANCE

FACILITY TYPE	NON-INTERSTATE
PROJECT LENGTH	2240 FT == > 0.42 Miles
# OF CENTERLINES	2 CL
# OF LANES	4 LANES
# OF EDGES	4 EP
LANE WIDTH - AVERAGE	12 FT
SHOULDER WIDTH	0 FT
HMA	Inside
HMA	Outside

PAVEMENT THICKNESS (FLEXIBLE)	10.00 IN	14.25 IN MAX
SHOULDER THICKNESS	10.00 IN	Standard Design
POLY OVERLAY THICKNESS	2.25 IN	

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		3.56	4.00	4.00

HMA COST PER TON	UNIT PRICE	Read Me!
HMA SURFACE	\$95.00 /TON	
HMA TOP BINDER	\$90.00 /TON	
HMA LOWER BINDER	\$85.00 /TON	
HMA BINDER (LEVELING)	\$80.00 /TON	
HMA SHOULDER	\$80.00 /TON	

INITIAL COSTS	THICKNESS	100% QUANTITY UNIT	UNIT PRICE	COST
ITEM				

HMA PAVEMENT (FULL-DEPTH)	(10.00")	11,947 SQ YD	\$45.36 /SQ YD	\$541,901
HMA SURFACE COURSE	(2.00")	11,947 SQ YD	\$10.81 /SQ YD	\$0
HMA TOP BINDER COURSE	(1.50")	11,947 SQ YD	\$11.59 /SQ YD	\$0
HMA LOWER BINDER COURSE	(5.75")	11,947 SQ YD	\$34.55 /SQ YD	\$0

HMA SHOULDER	(10.00")	0 TONS	\$80.00 /TON	\$0
CURB & GUTTER		0 LIN FT	\$30.00 /LIN FT	\$0
SUBBASE GRAN MAT'LTY C (TONS)		0 TONS	\$0.00 /TON	\$0
IMPROVED SUBGRADE	Aggregate	12,859 SQ YD	\$10.00 /SQ YD	\$128,590

Reserved For User Supplied Item		0 SQ YD	\$0.00 /SQ YD	\$0
Reserved For User Supplied Item		0 SQ YD	\$0.00 /SQ YD	\$0
PAVEMENT REMOVAL		0 SQ YD	\$0.00 /SQ YD	\$0
SHOULDER REMOVAL		0 SQ YD	\$0.00 /SQ YD	\$0

Note: * Denotes User Supplied Quantity				

FLEXIBLE CONSTRUCTION INITIAL COST	\$670,491
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	\$64,459

MAINTENANCE COSTS	THICKNESS	MATERIAL	UNIT PRICE	UNIT COST
ITEM				

ROUTINE MAINTENANCE ACTIVITY				\$0.00 LANE-MILE / YEAR
HMA OVERLAY P/MT SURF	(2.00")	(HMA SURFACE MIX)	2.00	\$10.81 /SQ YD
HMA OVERLAY P/MT	(2.25")	(HMA SURFACE MIX)	2.25	\$12.16 /SQ YD
HMA SURFACE MIX	(1.50")	(HMA SURFACE MIX)	1.50	\$8.11 /SQ YD
HMA BINDER MIX	(0.75")	(Leveling Binder Mix)	0.75	\$4.05 /SQ YD
HMA OVERLAY SHLD	(Year 30)	(HMA SHLD MIX)	2.25	\$0.00 /SQ YD
HMA OVERLAY SHLD	(2.00")	(HMA SHLD MIX)	2.00	\$0.00 /SQ YD

MILLING (2.00 IN)			2.00	\$2.50 /SQ YD
PARTIAL DEPTH P/MT PATCH	(MIL & Fill Surf)	(HMA SURFACE MIX)	2.00	\$90.00 /SQ YD
PARTIAL DEPTH SHLD PATCH	(MIL & Fill Surf)	(HMA SHLD MIX)	2.00	\$85.00 /SQ YD

PARTIAL DEPTH P/MT PATCH	(MIL & Fill +2.00")	(HMA L BINDER)	2.00	\$80.00 /SQ YD
PARTIAL DEPTH SHLD PATCH	(MIL & Fill +2.00")	(HMA SHLD MIX)	2.00	\$85.00 /SQ YD

LONGITUDINAL SHOULDER JOINT ROUT & SEAL				\$2.00 /LIN FT
CENTERLINE JOINT ROUT & SEAL				\$2.00 /LIN FT
RANDOM / THERMAL CRACK ROUT & SEAL				\$2.00 /LIN FT

(100% Rehab = 110.00' Station / Lane)				

FLEXIBLE TOTAL LIFE-CYCLE COST	\$991,847
FLEXIBLE TOTAL ANNUAL COST PER MILE	\$95,353

PCC PAVEMENT

JPCP

ROUTE Sanders Road
SECTION 1616-R
COUNTY Cook
LOCATION at Willow Road

FACILITY TYPE NON-INTERSTATE

PROJECT LENGTH 2240 FT = > 0.42 Miles
OF CENTERLINES 2 CL
OF LANES 4 LANES
OF EDGES 4 EP
LANE WIDTH - AVERAGE 12 FT
SHOULDER WIDTH 0 FT
PCC Inside
PCC Outside

PAVEMENT THICKNESS (RIGID) 9.00 IN
SHOULDER THICKNESS 9.00 IN

POLICY OVERLAY THICKNESS 2.50 IN

RIGID PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
Worksheet Construction Type is Reconstruction		5.02	5.29	JPCP

The Pavement Type is

INITIAL COSTS	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
JPC PAVEMENT	(9.00")	11,947	SQ YD	\$47.47 / SQ YD	\$567,124
PAVEMENT REINFORCEMENT		0	SQ YD	\$0.00 / SQ YD	\$0
STABILIZED SUBBASE	(4.50")	0	SQ YD	\$0.00 / SQ YD	\$0
PCC SHOULDERS	(9.00" to 9.00")	0	SQ YD	\$0.00 / SQ YD	\$0
CURB & GUTTER		0	LIN FT	\$30.00 / LIN FT	\$0
SUBBASE GRAN MATL TY C	#DIV0!	0	TONS	\$0.00 / TON	\$0
IMPROVED SUBGRADE:	Aggregate	12,444	SQ YD	\$10.00 / SQ YD	\$124,440
Reserved For User Supplied Item		0		\$0.00	\$0
Reserved For User Supplied Item		0		\$0.00	\$0
PAVEMENT REMOVAL		0	SQ YD	\$0.00 / SQ YD	\$0
SHOULDER REMOVAL		0	SQ YD	\$0.00 / SQ YD	\$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST \$591,564
RIGID CONSTRUCTION ANNUAL COST PER MILE \$66,485

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT PRICE	UNIT COST
ROUTINE MAINTENANCE ACTIVITY				
HMA POLICY OVERLAY	(2.50")			\$0.00 / LANE-MILE / YEAR
HMA POLICY OVERLAY PVMT	(2.50")			
HMA SURFACE MIX	(1.50")	HMA Surface Mix	1.13	\$13.51 / SQ YD
HMA BINDER MIX	(1.00")	Leveling Binder Mix	3.82	\$8.11 / SQ YD
HMA POLICY OVERLAY SHLD	(2.50")			\$5.41 / SQ YD
CLASS A PAVEMENT PATCHING				\$0.00 / SQ YD
CLASS B PAVEMENT PATCHING				\$170.00 / SQ YD
CLASS C SHOULD PATCHING				\$130.00 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf)		(HMA SURFACE MIX)	1.50	\$90.00 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")		(HMA SURFACE MIX)	2.36	\$85.00 / SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL				\$2.00 / LIN FT
CENTERLINE JOINT ROUT & SEAL				\$2.00 / LIN FT
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL				\$2.00 / LIN FT
RANDOM CRACK ROUT & SEAL		(100% Rehab = 100.00 / Station / Lane)		\$2.00 / LIN FT

RIGID TOTAL LIFE-CYCLE COST \$873,857
RIGID TOTAL ANNUAL COST PER MILE \$84,010

MAINTENANCE

FULL-DEPTH HMA PAVEMENT
HMA OVERLAY OF RUBBLIZED PCC PAVEMENT
Figure 54-7.C
STANDARD DESIGN

MAINTENANCE COSTS:	ITEM		%	QUANTITY	UNIT COST	COST	PRESENT WORTH
YEAR 5							
	LONG SHLD JT R&S	LIN FT	100.00%	8,960	\$2.00	\$17,920	
	CNTR LINE JOINT R&S	LIN FT	100.00%	4,480	\$2.00	\$8,960	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	4,928	\$2.00	\$9,856	
	PD PVMT PATCH M&F SURF	SQ YD	0.10%	12	\$90.00	\$1,080	
	PWFn =		0.8626	PW =	0.8626 X	\$37,816	\$32,620
YEAR 10							
	LONG SHLD JT R&S	LIN FT	100.00%	8,960	\$2.00	\$17,920	
	CNTR LINE JOINT R&S	LIN FT	100.00%	4,480	\$2.00	\$8,960	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	4,928	\$2.00	\$9,856	
	PD PVMT PATCH M&F SURF	SQ YD	0.50%	60	\$90.00	\$5,400	
	PWFn =		0.7441	PW =	0.7441 X	\$42,136	\$31,353
YEAR 15							
	MILL PVMT & SHLD 2.00"	SQ YD	100.00%	11,947	\$2.50	\$29,868	
	PD PVMT PATCH M&F ADD'L 2.00"	SQ YD	1.00%	119	\$90.00	\$10,710	
	HMA OVERLAY PVMT 2.00"	SQ YD	100.00%	11,947	\$10.81	\$129,147	
	HMA OVERLAY SHLD 2.00 "	SQ YD	100.00%	0	\$0.00	\$0	
	PWFn =		0.6419	PW =	0.6419 X	\$169,725	\$108,940
YEAR 20							
	LONG SHLD JT R&S	LIN FT	100.00%	8,960	\$2.00	\$17,920	
	CNTR LINE JOINT R&S	LIN FT	100.00%	4,480	\$2.00	\$8,960	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	4,928	\$2.00	\$9,856	
	PD PVMT PATCH M&F SURF	SQ YD	0.10%	12	\$90.00	\$1,080	
	PWFn =		0.5537	PW =	0.5537 X	\$37,816	\$20,938
YEAR 25							
	LONG SHLD JT R&S	LIN FT	100.00%	8,960	\$2.00	\$17,920	
	CNTR LINE JOINT R&S	LIN FT	100.00%	4,480	\$2.00	\$8,960	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	4,928	\$2.00	\$9,856	
	PD PVMT PATCH M&F SURF	SQ YD	0.50%	60	\$90.00	\$5,400	
	PWFn =		0.4776	PW =	0.4776 X	\$42,136	\$20,124
HMA SD							
YEAR 30							
	NON-INTERSTATE						
	MILL PVMT & SHLD 2.00"	SQ YD	100.00%	11,947	\$2.50	\$29,868	
	PD PVMT PATCH M&F ADD'L 2.00"	SQ YD	2.00%	239	\$90.00	\$21,510	
	PD SHLD PATCH M&F ADD'L 2.00"	SQ YD	1.00%	0	\$85.00	\$0	
	HMA OVERLAY PVMT 2.25"	SQ YD	100.00%	11,947	\$12.16	\$145,290	
	HMA OVERLAY SHLD 2.25 "	SQ YD	100.00%	0	\$0.00	\$0	
	PWFn =		0.4120	PW =	0.4120 X	\$196,668	\$81,025
YEAR 35							
	LONG SHLD JT R&S	LIN FT	100.00%	8,960	\$2.00	\$17,920	
	CNTR LINE JOINT R&S	LIN FT	100.00%	4,480	\$2.00	\$8,960	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	4,928	\$2.00	\$9,856	
	PD PVMT PATCH M&F SURF	SQ YD	0.10%	12	\$90.00	\$1,080	
	PWFn =		0.3554	PW =	0.3554 X	\$37,816	\$13,439
YEAR 40							
	LONG SHLD JT R&S	LIN FT	100.00%	8,960	\$2.00	\$17,920	
	CNTR LINE JOINT R&S	LIN FT	100.00%	4,480	\$2.00	\$8,960	
	RNDM / THRM CRACK R&S	LIN FT	50.00%	4,928	\$2.00	\$9,856	
	PD PVMT PATCH M&F SURF	SQ YD	0.50%	60	\$90.00	\$5,400	
	PWFn =		0.3066	PW =	0.3066 X	\$42,136	\$12,917
							\$321,356
ROUTINE MAINTENANCE ACTIVITY				1.70	0.00	\$0	\$0
MAINTENANCE LIFE-CYCLE COST							\$321,356
45 YEARS	CRFn =	0.040785	MAINTENANCE ANNUAL COST PER MILE				\$30,894

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

11/07/13

JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT COST	COST	PRESENT WORTH
YEAR 10						
	PAVEMENT PATCH CLASS B	SQ YD	0.10%	12	\$130.00	\$1,560
		PWF _n =	0.7441	PW =	0.7441 X	\$1,560
						\$1,161
YEAR 15						
	PAVEMENT PATCH CLASS B	SQ YD	0.20%	24	\$130.00	\$3,120
		PWF _n =	0.6419	PW =	0.6419 X	\$3,120
						\$2,003
YEAR 20						
	PAVEMENT PATCH CLASS B	SQ YD	2.00%	239	\$130.00	\$31,070
	SHOULDER PATCH CLASS C	SQ YD	0.50%	0	\$80.00	\$0
	LONGITUDINAL SHLD JT R&S	LIN FT	100.00%	8,960	\$2.00	\$17,920
	CENTERLINE JT R&S	LIN FT	100.00%	4,480	\$2.00	\$8,960
		PWF _n =	0.5537	PW =	0.5537 X	\$57,950
						\$32,086
YEAR 25						
	PAVEMENT PATCH CLASS B	SQ YD	3.00%	358	\$130.00	\$46,540
	SHOULDER PATCH CLASS C	SQ YD	1.00%	0	\$80.00	\$0
		PWF _n =	0.4776	PW =	0.4776 X	\$46,540
						\$22,228
YEAR 30	NON-INTERSTATE					
	PAVEMENT PATCH CLASS B	SQ YD	4.00%	478	\$130.00	\$62,140
	SHOULDER PATCH CLASS C	SQ YD	1.50%	0	\$80.00	\$0
	HMA POLICY OVERLAY 2.5" (PVM)	SQ YD	100.00%	11,947	\$13.51	\$161,434
	HMA POLICY OVERLAY 2.5" (SHLI)	SQ YD	100.00%	0	\$0.00	\$0
		PWF _n =	0.4120	PW =	0.4120 X	\$223,574
						\$92,110
YEAR 35	NON-INTERSTATE					
	LONGITUDINAL SHLD JT R&S	LIN FT	100.00%	8,960	\$2.00	\$17,920
	CENTERLINE JT R&S	LIN FT	100.00%	4,480	\$2.00	\$8,960
	RANDOM CRACK R&S	LIN FT	50.00%	4,480	\$2.00	\$8,960
	REFLECTIVE TRANSVERSE CRACK	LIN FT	40.00%	2,861	\$2.00	\$5,722
	PD PVMT PATCH M&F HMA 2.50"	SQ YD	0.10%	12	\$85.00	\$1,020
		PWF _n =	0.3554	PW =	0.3554 X	\$42,582
						\$15,133
YEAR 40	NON-INTERSTATE					
	PAVEMENT PATCH CLASS B	SQ YD	0.50%	60	\$130.00	\$7,800
	LONGITUDINAL SHLD JT R&S	LIN FT	100.00%	8,960	\$2.00	\$17,920
	CENTERLINE JT R&S	LIN FT	100.00%	4,480	\$2.00	\$8,960
	REFLECTIVE TRANSVERSE CRACK	LIN FT	60.00%	4,291	\$2.00	\$8,582
	RANDOM CRACK R&S	LIN FT	50.00%	4,480	\$2.00	\$8,960
	PD PVMT PATCH M&F HMA 2.50"	SQ YD	0.50%	60	\$85.00	\$5,100
		PWF _n =	0.3066	PW =	0.3066 X	\$57,322
						\$17,572
						\$182,293
	ROUTINE MAINTENANCE ACTIVITY			1.70	\$0.00	\$0
						\$0
45 YEARS	CRF _n =	0.040785			MAINTENANCE LIFE-CYCLE COST	\$182,293
					MAINTENANCE ANNUAL COST PER MILE	\$17,525

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 4:02 PM 09/20/2012

	INITIAL COST	JPCP		HMA	
CONSTRUCTION		PRESENT WORTH	\$691,564	PRESENT WORTH	\$670,491
		ANNUAL COST PER MILE	\$66,485	ANNUAL COST PER MILE	\$64,459
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$182,293	PRESENT WORTH	\$321,356
		ANNUAL COST PER MILE	\$17,525	ANNUAL COST PER MILE	\$30,894
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$873,857	PRESENT WORTH	\$991,847
		ANNUAL COST PER MILE	\$84,010	ANNUAL COST PER MILE	\$95,353

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>	JPCP	\$84,010
OTHER OPTIONS (LOWEST TO HIGHEST):		HMA	\$95,353
			13.5%